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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte AVETIK HARUTYUNYAN

Appeal 2010-002154
Application 10/727,699
Technology Center 1700

Before ADRIENE LEPIANE HANLON, PETER F. KRATZ, and MARK NAGUMO, *Administrative Patent Judges.*

NAGUMO, *Administrative Patent Judge.*

DECISION ON APPEAL[1]

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[1] The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, or for filing a request for rehearing, as recited in 37 C.F.R. § 41.52, begins to run from the "MAIL DATE" (paper delivery mode) or the "NOTIFICATION DATE" (electronic delivery mode) shown on the PTOL-90A cover letter attached to this decision.

A. Introduction[2]

Avetik Harutyunyan ("Harutyunyan") timely appeals under 35 U.S.C. § 134(a) from the final rejection[3] of claims 1-5, 7, 8, 10-18, and 38-49, which are all of the pending claims. We have jurisdiction under 35 U.S.C. § 6. We REVERSE.

The subject matter on appeal relates to processes for forming single walled carbon nanotubes ("SWNT"). The 699 Specification uses the term to mean a "cylindrically shaped thin sheet of carbon atoms having a wall consisting essentially of a single layer of carbon atoms, and arranged in an hexagonal crystalline structure with a graphitic type of bonding." (Spec. 8 [0022].) The SWNT are made from a carbon precursor gas, such as methane, using as a catalyst metal nanoparticles supported on powdered oxide supports. (*Id.* at 5 [0012].) The supported catalysts are "entrained"—i.e., taken up—into a gas and delivered into a reaction chamber where the carbon precursor gas is catalytically reduced to produce SWNT. (*Id.*)

Representative Claim 1 reads:

> 1. A method for synthesizing carbon nanostructures, the method comprising:

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[2] Application 10/727,699, *Systems and Methods for Production of Carbon Nanostructures*, filed 3 December 2003. The specification is referred to as the "699 Specification," and is cited as "Spec." The real party in interest is listed as Honda Motor Co. (Appeal Brief, filed 18 December 2008 ("Br."), 1.)

[3] Office action mailed 18 December 2007 ("Final Rejection"; cited as "FR").

providing a catalyst of metal nanoparticles, wherein the catalyst is supported on a powdered oxide substrate having a particle size of 0.5 μm to 5 μm;

entraining the catalyst in an inert gas; and

exposing the entrained catalyst to a carbon precursor gas at a temperature sufficient to form carbon nanostructures,

wherein the carbon nanostructure is single-walled carbon nanotubes.

(Claims App., Br. 9; indentation and paragraphing added.)

The Examiner has maintained the following grounds of rejection:[4]

A. Claims 1-3, 5, 7, 8, 10-18, 38, 39, and 41-49 stand rejected under 35 U.S.C. § 103(a) in view of the teachings of Tennent.[5]

B. Claims 4 and 40 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Tennent and Moy.[6]

B. Discussion

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

Two facts dispositive of this appeal are, as Harutyunyan argues, that Tennent teaches carbon fibrils, and does not teach or suggest SWNT (Br. 7; Reply 4-5); and that Tennent does not teach entrainment of supported catalytic particles (Br. 5, 1st para.). Moreover, although Moy, on which the

[4] Examiner's Answer mailed 6 July 2009 ("Ans.").

[5] Howard G. Tennent, *Carbon Fibrils, Method for Producing Same and compositions Containing Same*, U.S. Patent 4,663,230 (1987).

[6] David Moy and Asif Chishti, *Process for Producing Single Wall Nanotubes Using Unsupported Metal Catalysts*, U.S. Patent 6,221,330 B1 (2001).

Examiner relies as evidence of the obviousness of using a molybdenum catalyst (Ans. 5), does teach the synthesis of SWNT, only unsupported metal containing catalysts are taught or suggested.

The term "single walled nanotube" is a well established term of art having a generally understood definition that is consistent with the definition provided by the 699 Specification quoted *supra*. As Moy discusses, Tennent describes growing smaller carbon fibrils than previous attempts, having cylindrical ordered graphite cores that are uncontaminated with pyrolytic carbon. (Moy, col. 1, ll. 55-67.) According to Moy, the structures described by Tennent are now generally accepted as being multi-walled carbon nanotubes ("MWNT"). (*Id.* at col. 2, ll. 18-27; *see also* Tennent, col. 7, ll. 5-17, describing the carbon fibrils.)

On the present record, Harutyunyan's arguments that the carbon fibrils taught by Tennent were recognized as being distinct from SWNT, and that the latter were not regarded as obvious variants of the former, are supported by substantial evidence in the record. In contrast, the Examiner has not directed our attention to any credible evidence in the record that supports the argument (Ans. 7, 2d full para.) that the nano-sized carbon fibrils, or MWNT, would have suggested SWNT. Thus, reversal is proper on this basis.

Moreover, although Harutyunyan appears to have overlooked the disclosure by Tennent that nanometer-sized metal particles are deposited on oxide particles (Catalyst Preparation Examples 2, 3, 4, and 6); those particles are then dispersed on a ceramic boat. (Tennent, col. 10, ll. 48-49 (Example 15) and ll. 66-67 (Example 28).) Tennent's teaching that, "[f]or

ease of removal, their [catalyst support materials] preferred physical form is thin films or plates which can easily be moved into and out of the reactor" (Tennent, col. 6, ll. 20-22; cited at Br. 5, last para.) is consistent with Harutyunyan's argument that Tennent does not teach entrainment of the catalyst particles. Moreover, Tennent's remark that small metal particles can be formed in the reactor from a precursor vapor, leading to the "advantage that fibril growth is initiated throughout the reactor volume, giving higher productivity than when the catalyst particles are introduced on supports" (Tennent, col. 6, ll. 26-29), indicates that Tennent does not contemplate entrainment of supported catalyst particles.

In contrast, the Examiner has not directed our attention to any credible evidence of record that supports the Examiner's finding (Ans. 3) that the supported catalyst particles are entrained, i.e., taken up, into an inert carrier gas.

The Examiner's reliance on Moy does not cure the deficiencies of Tennent already discussed. In this regard, we note that Moy does acknowledge that supported metal catalysts have been used to make SWNT. (Moy, col. 2, ll. 58-64.) However, Moy teaches that "supported metal catalysts are inherently disadvantageous, as the support is necessarily incorporated into the single-walled carbon nanotube formed therefrom." (Moy, col. 2, ll. 65-67.) While this is not a "teaching away," in that it is not a statement that supported catalysts cannot or should not be used to make SWNT, *see, e.g.*, *Para-Ordnance Manufacturing, Inc. v. SGS Importers International, Inc.*, 73 F.3d 1085, 1090 (Fed. Cir. 1995), it is far from an encouragement to use supported catalysts to form SWNT. In particular, the

Examiner has pointed to nothing in Moy that would have suggested that supported catalysts be entrained in a carrier gas in processes of forming SWNT.

In summary, the weight of the evidence supports Harutyunyan's arguments that Tennent does not disclose a process in which supported metal catalysts are entrained in a gas, or that it would have been obvious to modify such a process to produce SWNT.

C. Order

We REVERSE the rejection of claims 1-3, 5, 7, 8, 10-18, 38, 39, and 41-49 under 35 U.S.C. § 103(a) in view of the teachings of Tennent.

We REVERSE the rejection of claims 4 and 40 under 35 U.S.C. § 103(a) in view of the combined teachings of Tennent and Moy.

REVERSED

tc

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